

Knowns and Unknowns on Health and Environmental Justice for PFAS

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*Social Science Environmental Health
Research Institute*

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1R13 ES028097-01, 1R13ES030609-01), NSF (SES-0924241, SES-1456897)**

Much of this presentation is the result of collaboration with Prof. Alissa Cordner, my co-leader of the PFAS Project Lab, as well as the work of all the members of our team

The screenshot shows the homepage of the PFAS Project Lab. At the top, there is a dark header with the SSEHRI logo (Social Science, Environmental Health, Research Institute) and the text 'THE PFAS PROJECT LAB' and 'Studying Social, Scientific, and Political Factors of Per- and Polyfluoroalkyl Substances'. Below the header is a green navigation bar with links for HOME, ABOUT US, PUBLICATIONS & PRESENTATIONS, TIMELINES, CONTAMINATION SITE TRACKER, and ADDITIONAL RESOURCES. The main content area features a grid of news articles, each with a thumbnail image, a title, and a date. On the right side, there is a search bar, a 'PFAS NEWSLETTER' sign-up section, and a 'FEATURED POSTS' section with several article titles. At the bottom right, there is a 'MAPPING CONTAMINATION SITES' section with links to a 'PFAS Exchange Map' and an 'Australian PFAS Chemicals Map'. The footer area contains 'SSEHRI IN THE NEWS' with several news snippets.

SSEHRI
Social Science, Environmental Health
Research Institute

THE PFAS PROJECT LAB
Studying Social, Scientific, and Political Factors of Per- and Polyfluoroalkyl Substances

HOME ABOUT US PUBLICATIONS & PRESENTATIONS TIMELINES CONTAMINATION SITE TRACKER ADDITIONAL RESOURCES

NEWS
EPA Proposes Collecting Data From PFAS Manufacturers
July 3, 2021 — 0 Comments

NEWS
Exxon lobbyist says it pushed trade groups to 'be out front' on forever chemicals in activist recording
July 3, 2021 — 0 Comments

NEWS
President Biden addresses PFAS issue in La Crosse speech
June 30, 2021 — 0 Comments

NEWS
3M comments on pollution scandal: 'We will accept our responsibilities'
June 30, 2021 — 0 Comments

NEWS, SSEHRI
Improved medical screening in PFAS-impacted communities to identify early disease
June 29, 2021 — 0 Comments

NEWS
Unclear if Ford Airport will help foot the bill, township moves forward with plan to bring residents clean water
June 28, 2021 — 0 Comments

SEARCH

PFAS NEWSLETTER
Join the mailing list to receive updates in PFAS science, regulation, and activism

FEATURED POSTS

- Journal of Health and Social Behavior: COVID-19 as Eco-Pandemic Injustice
- NYT: Firefighters Battle an Unseen Hazard: Their Gear Could Be Toxic
- GQ: Is Your Beloved Outdoor Gear Bad for the Planet?
- ABC: DuPont, Chemours reach \$4 billion agreement over 'forever chemicals'

MAPPING CONTAMINATION SITES

- PFAS Exchange Map
- Australian PFAS Chemicals Map (not affiliated with SSEHRI)

SSEHRI IN THE NEWS

- Environmental Health News: Improved medical screening in PFAS-impacted communities to identify early disease featuring Isabella Rapani, Phil Brown, and Alissa Cordner
- Charleston Gazette-Mail: WV congressional delegation not on same page on legislation targeting PFAS featuring Phil Brown
- INFORUM: 'Forever chemicals' contaminate sites across North Dakota, including in Fargo featuring Alissa Cordner
- Record-Eagle: FOIA shows travel voucher idea for PFAS-contaminated well owners in

Co-Directors

Phil Brown – Northeastern University

Alissa Cordner – Whitman College

Collaborating Faculty and Scientists

- Julia Varshavsky – Northeastern
- Rosie Mueller – Whitman College
- Lauren Richter – Rhode Island School of Design
- Jennifer Ohayon – Silent Spring Institute
- Laurel Schaidler – Silent Spring Institute
- Ruthann Rudel – Silent Spring Institute
- Julie Brody – Silent Spring Institute
- Vincent Bessonneau – Silent Spring Institute
- Maia Fitzstevens – Silent Spring Institute
- Farzad Noubary – Northeastern
- Maddy Poehlin

Postdoctoral Fellow

- Martha Powers – Northeastern

Graduate Students

- Isabel Geisler – Northeastern
- Grace Poudrier – Northeastern
- Marina Atlas – Northeastern
- Miranda Dotson – Northeastern

Undergraduates

- Lilyana Ibañez – Northeastern
- Cole Alder – Northeastern
- Derrick Salvatore – Northeastern
- Kira Mok -- Northeastern
- Isabella Raponi – Northeastern
- Jamie Zwaschka – Whitman College
- Helena Zindel – Whitman College
- Berty Lakhjohn – Whitman College
- Anna Allgeyer – Whitman College

Community and Organizational Collaborators

- Testing for Pease
- Massachusetts Breast Cancer Coalition
- Community Action Works (previously Toxics Action Center)
- Green Science Policy Institute
- National PFAS Contamination Coalition

Thanks to the Massachusetts Legislature
for your strong engagement with PFAS

...and for being part of a state government that has taken many environmental health issues so seriously, including DEP issuing some of the strongest Maximum Contaminant Levels (MCLs) for PFAS in the US



I've been asked to address:

- Significant gaps in our knowledge of, and awareness efforts on, PFAS and its health effects
- The inequitable community impacts of PFAS along race and class lines
- Ideas and recommendations for the Task Force's consideration

Massachusetts Drinking Water Standard and Health Information

PFAS Standard for Public Drinking Water Supplies

On October 2, 2020, MassDEP published its PFAS public drinking water standard, called a Massachusetts Maximum Contamination Level (MMCL), of 20 nanograms per liter (ng/L) (or parts per trillion (ppt)) – individually or for the sum of the concentrations of six specific PFAS. These PFAS are perfluorooctane sulfonic acid (PFOS); perfluorooctanoic acid (PFOA); perfluorohexane sulfonic acid (PFHxS); perfluorononanoic acid (PFNA); perfluoroheptanoic acid (PFHpA); and perfluorodecanoic acid (PFDA). MassDEP abbreviates this set of six PFAS as "PFAS6." This drinking water standard is set to be protective against adverse health effects for all people consuming the water.

1. Gaps in knowledge and action

Decades of Industry Research and Secrecy

- 1961 – DuPont finds evidence of liver toxicity in animals
- 1962 – DuPont finds evidence of toxicity in humans
- 1976 – 3M finds PFOA in workers' blood
- 1981 – 3M finds PFOA causes rare birth defects in rats
- 1981 – DuPont workers give birth to infants with similar rare birth defects; DuPont removes all women workers from Teflon unit but doesn't say why and doesn't share this data with EPA
- 1984 – DuPont finds PFOA in community drinking water, doesn't disclose results
- 1987 – 3M looks for uncontaminated blood samples to compare to their workers and finds widespread global contamination

For more details: DuPont and 3M documents in EWG's Chemical Industry Archives; Toxic Docs (Columbia SPH); Callie Lyons *Stain Resistant, Non-stick, Waterproof and Lethal: The Hidden Dangers of C8* (2007)

Barriers to information

- Confidential business information
- Quick turnaround at EPA of new-use applications
- Reporting under TRI only just started
- Many small facilities will be exempt from TRI
- Industry denial and falsehoods, e.g. American Chemistry Council
- Industry suing states over regulations (e.g. 3M in New Hampshire)
- We don't know all the sources

PFAS sources in the environment: Continued expansion

Traditional sources

- Production facilities
- Other industries that incorporate PFAS
- *Later on:* AFFF firefighting foams for fuel fires

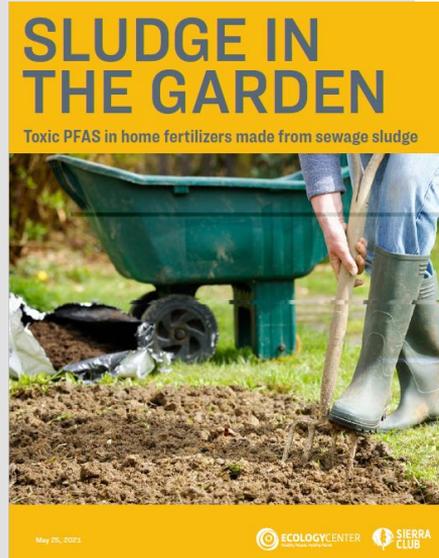
More recent sources

- Landfills
- Wastewater treatment plants and biosolids
- Food packaging
- Food grown with sludge
- Septic systems



Expansion of likely sources

- Now food is a major concern – dairy and crops raised on sludge, contact through food packaging and wrapping
- Chrome-plating and other metal-plating shops
- Refineries
- Oil rigs
- Bulk fuel storage
- Munitions facilities



Initial test results reveal 'forever chemicals' showing up in sludge

pressherald.com/2019/05/22/initial-test-results-show-forever-chemicals-showing-up-in-sludge/

By Kevin Miller Staff
Writer

May 23,
2019



SCIENTIFIC OPINION



ADOPTED: 22 March 2018

doi: 10.2903/j.efsa.2018.5194

Risk to human health related to the presence of perfluorooctane sulfonic acid and perfluorooctanoic acid in food

EFSA Panel on Contaminants in the Food Chain (CONTAM),
Helle Katrine Knutsen, Jan Alexander, Lars Barregård, Margherita Bignami, Beat Brüschweiler,
Sandra Ceccatelli, Bruce Cottrill, Michael Dinovi, Lutz Edler, Bettina Grasl-Kraupp,
Christer Hogstrand, Laurentius (Ron) Hoogenboom, Carlo Stefano Nebbia, Isabelle P Oswald,
Annette Petersen, Martin Rose, Alain-Claude Roudot, Christiane Vleminckx, Günter Vollmer,
Heather Wallace, Laurent Bodin, Jean-Pierre Cravedi, Thorhallur Ingi Halldorsson,
Line Smastuen Haug, Niklas Johansson, Henk van Loveren, Petra Gergelova, Karen Mackay,
Sara Levorato, Mathijs van Manen and Tanja Schwerdtle

Abstract

The European Commission asked EFSA for a scientific evaluation on the risks to human health related to the presence of perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) in food. Regarding PFOS and PFOA occurrence, the final data set available for dietary exposure assessment contained a total of 20,019 analytical results (PFOS $n = 10,191$ and PFOA $n = 9,828$). There were large differences between upper and lower bound exposure due to analytical methods with insufficient sensitivity. The CONTAM Panel considered the lower bound estimates to be closer to true exposure levels. Important contributors to the lower bound mean chronic exposure were 'Fish and other seafood', 'Meat and meat products' and 'Eggs and egg products', for PFOS, and 'Milk and dairy products', 'Drinking water' and 'Fish and other seafood' for PFOA. PFOS and PFOA are readily absorbed in the gastrointestinal tract, excreted in urine and faeces, and do not undergo metabolism. Estimated human half-lives for PFOS and PFOA are about 5 years and 2-4 years, respectively. The derivation of a health-based guidance value was based on human epidemiological studies. For PFOS, the increase in serum total cholesterol in adults, and the decrease in antibody response at vaccination in children were identified as the critical effects. For PFOA, the increase in serum total cholesterol was the critical effect. Also reduced birth weight (for both compounds) and increased prevalence of high serum levels of the liver enzyme alanine aminotransferase (ALT) (for PFOA) were considered. After benchmark modelling of serum levels of PFOS and PFOA, and estimating the corresponding daily intakes, the CONTAM Panel established a tolerable weekly intake (TWI) of 13 ng/kg body weight (bw) per week for PFOS and 6 ng/kg bw per week for PFOA. For both compounds, exposure of a considerable proportion

the majority
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only about 40
ew testing
early returns
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nicipal

Documented Health Effects: C8 Health Panel 2005-2013

- Thyroid disease
- Kidney cancer
- High cholesterol
- Ulcerative colitis
- Pregnancy-induced hypertension
- Testicular cancer

Documented Health Effects: Other Studies

—International Agency for Research on Cancer

—PFOA possibly carcinogenic in humans

—Other research

—Hormonal changes

—Liver malfunction

—Obesity

—Immunotoxicity, incl. interference with child vaccine response

—Lower birth weight and size

—Delayed puberty, decreased fertility, early menopause

—Reduced testosterone

—Prostate cancer

—Ovarian cancer



A class-based approach to PFAS is needed

When looking at long-chain compared to alternatives/next generation, replacement is not the answer

- Concerns about toxicity, bioaccumulation, and persistence led industry to phase-out production of long-chain PFAS by 2015 (EPA PFOA Stewardship Program)
- Replacement compounds: Short-chain PFASs
 - PFHxA, PFBS, NextGen, short-chain fluorotelomer, 6:2 FTOH, etc.
 - Likely less bioaccumulative...
 - ... But significant exposure and toxicity concerns, mobility in environment, persistence, and significant data gaps



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ACS EDITORS'
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Global Perspective

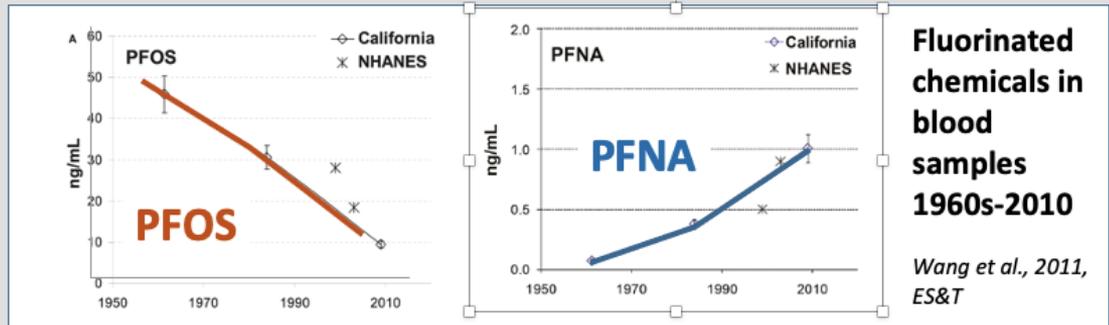
Scientific Basis for Managing PFAS as a Chemical Class

Carol F. Kwiatkowski,* David Q. Andrews, Linda S. Birnbaum, Thomas A. Bruton, Jamie C. DeWitt, Detlef R. U. Knappe, Maricel V. Maffini, Mark F. Miller, Katherine E. Pelch, Anna Reade, Anna Soehl, Xenia Trier, Marta Venier, Charlotte C. Wagner, Zhanyun Wang, and Arlene Blum

...because whack-a-mole approach to chemical policy doesn't work



Regrettable Substitution



2. Inequitable impacts

What is environmental justice?

Environmental justice: “the right of all people to share equally in the benefits bestowed by a healthy environment”

The **environment:** “the places in which we live, work, play, and worship”

(Adams, Evans, and Stein 2002)

“environmental **privilege** cannot exist without environmental injustice”

(Park and Pellow 2011)

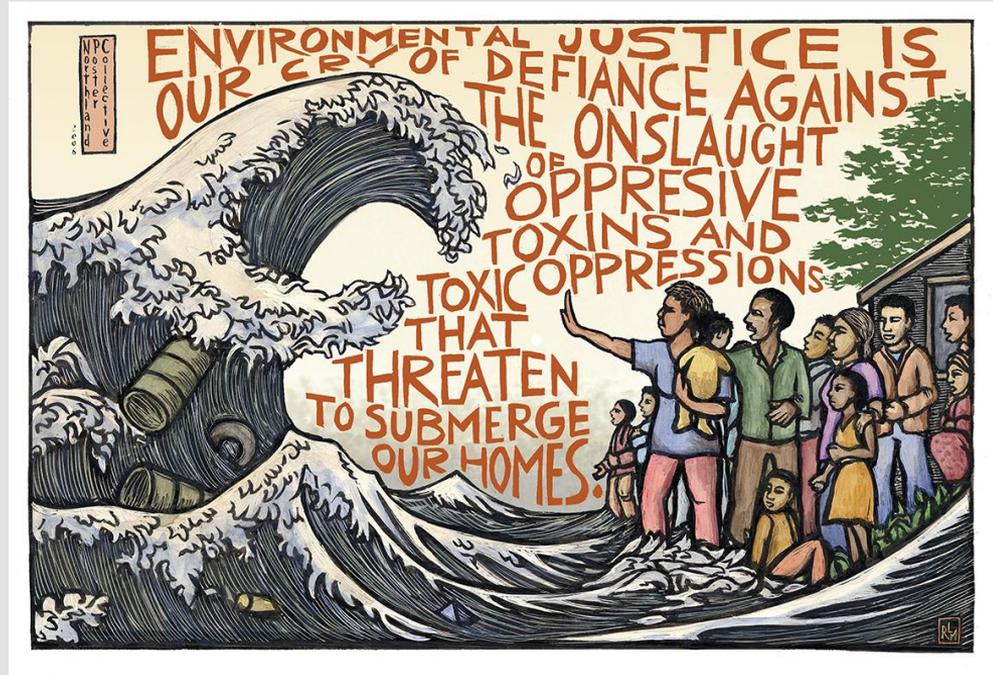


Image: Ricardo Lemins Morales, 2006

Toxic chemicals and unequal exposure

Decades of research documents uneven distribution of environmental hazards for Black, Indigenous, and People of Color and low-income communities

- More likely to live near hazardous and industrial facilities
- Higher levels of exposure to air and water pollutants
- Higher rates of illnesses associated with environmental pollution
- Higher levels of toxic chemicals from some consumer and household products
- Slower clean-up and less protective clean-up standards
- Less meaningful participation in environmental decision-making

EJ attention to *cumulative* exposure, including chemical and non-chemical stressors

PFAS exposure and Inequality?

Potentially few inequities?

- PFAS exposure is ubiquitous
- Many exposure pathways, not just from industry
- For some other chemicals, body burden is higher in high-SES populations

Potentially significant inequities?

- PFAS contamination at military bases
- Industrial sources of exposure sources (linked to residential discrimination)
- Low-income and BIPOC communities more likely to receive drinking water in violation of federal standards

Existing research on PFAS and exposure distribution

- African American women had lower levels of two PFAS in blood compared to non-Hispanic White women
- Positive associations between income and education levels with PFAS
- Non-Hispanic Black Americans and Asian Americans have highest exposure to certain PFAS

Journal of Exposure Science & Environmental Epidemiology (2019) 29:206–217
<https://doi.org/10.1038/s41370-018-0109-y>

ARTICLE

Serum concentrations of PFASs and exposure-related behaviors in African American and non-Hispanic white women

Katherine E. Boronow¹ · Julia Green Brody¹ · Laurel A. Schaidler¹ · Graham F. Peaslee² · Laurie Havas³ · Barbara A. Cohn⁴



International Journal of
*Environmental Research
and Public Health*

MDPI

Article

Socio-Economic Status and Health: Evaluation of Human Biomonitoring Chemical Exposure to Per- and Polyfluorinated Substances across Status

Jurgen Buekers^{1,*}, Ann Colles¹, Christa Cornelis¹, Bert Morrens², Eva Govarts¹ and Greet Schoeters¹



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National Report on Human Exposure to Environmental Chemicals

CDC    

 National Exposure Report Home

Updated Tables

About the CDC's

Early Release: Per- and Polyfluorinated Substances (PFAS) Tables, NHANES 2011–2018

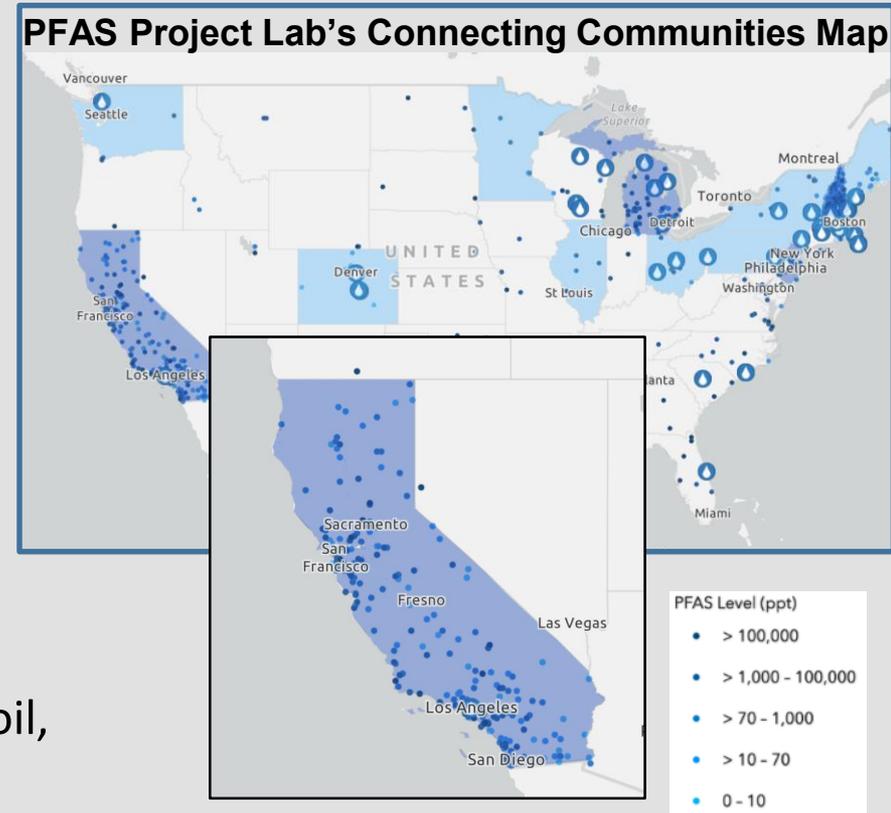
Existing knowledge about PFAS might underestimate inequalities

Uneven testing may reflect:

- Communities with more social capital
- States with more resources and technical capacity
- Large water systems (federal UCMR testing)
- Prior testing locations

Testing has largely overlooked:

- Small water systems
- Private wells
- Non-drinking water contamination (soil, wastewater, landfills)



Our research: NJ public drinking water systems and community demographics

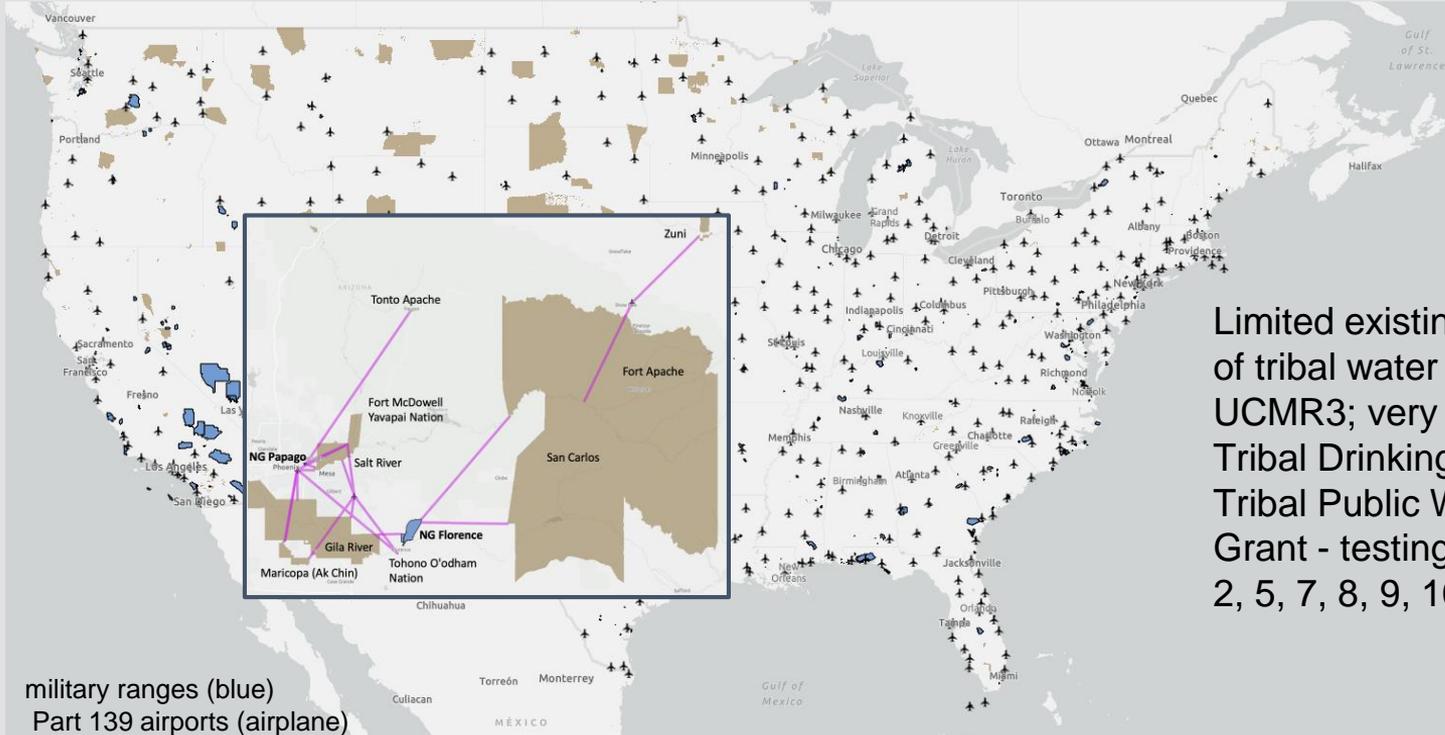
Looks at statewide monitoring system; that avoids selective monitoring and social capital resources

Demographic data from more than 6,000 NJ census block groups

Very preliminary data analysis

- **61% of all tested public water systems (PWSs) have detections of PFAS in public drinking water (\geq NJ MCLs), collectively serving 82% of NJ's population that receives water from community water systems.**
- **PWSs serving higher proportions of Black, Hispanic, and Asian populations have higher PFAS detections and higher exposures above state regulatory limits.**

Our research: Tribal lands



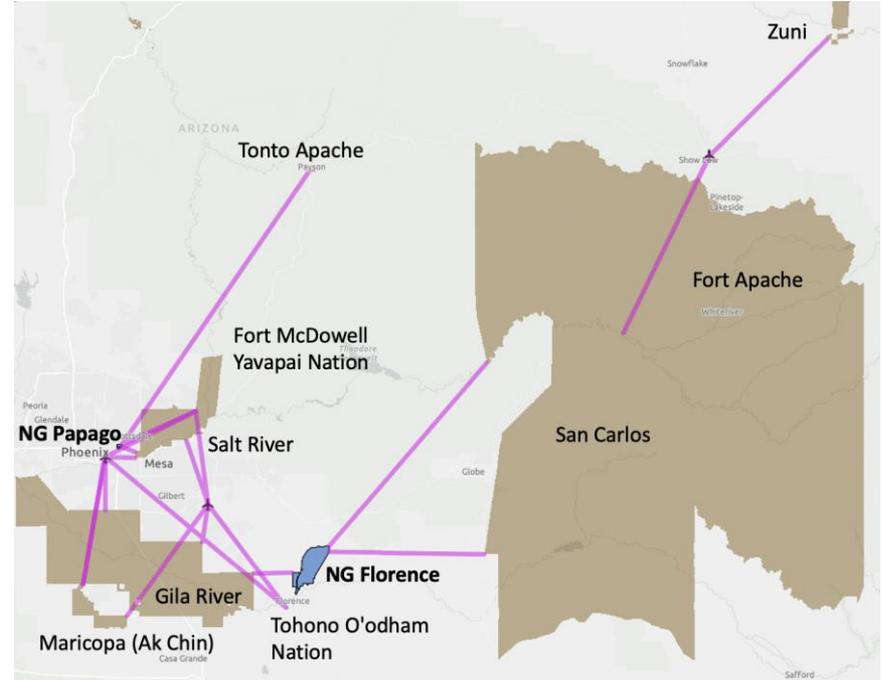
Limited existing testing - only about 3% of tribal water systems tested in UCMR3; very little DoD testing; EPA Tribal Drinking Water testing under the Tribal Public Water System Supervision Grant - testing planned in EPA Regions 2, 5, 7, 8, 9, 10

military ranges (blue)
Part 139 airports (airplane)
Tribal lands (brown)

Tribal lands – Arizona details

This region is notable because Gila River (7.46 miles from National Guard Florence and 7.14 miles from Phoenix-Mesa Gateway Airport) is the only Tribe that tested for and detected PFAS in UCMR3: 120 ppt PFOS, 46 ppt PFHxS, and 11 ppt PFHpA.

- Part 139 airports - “As indicated by the Federal Aviation Administration (FAA)¹, all Title 14, Code of Federal Regulations, Part 139 certified airports are required to provide aircraft rescue and firefighting services” and therefore have “been certified by the FAA to use AFFF compounds.”



Upcoming water sampling on Tribal lands

- Standing Rock Sioux (North Dakota)



- 4 New England Tribes – not yet publicly announced, and some may wish to remain anonymous

Also planned: Testing for PFAS in groundwater in Puerto Rico as part of Superfund Research Program

- Puerto Rico is very under-studied in terms of environmental health, and is totally an environmental justice island



Community Engagement and Policy

Need to directly engage with formal community groups and with impacted residents

Need for research and policy that amplifies the voices and experiences of impacted residents and groups

Example: NASEM Town Halls



Community Engagement and Policy

Significant attention by U.S. EPA and federal Executive Branch

Registration Open for Environmental Justice Academy in Dayton
Release Date: 06/07/2021

EPA Commits to Helping Sacramento Food Hubs
Release Date: 06/03/2021

Biden Administration Pledges to Assist City of Norfolk in Tackling Food Insecurity
Release Date: 06/03/2021

EPA Commits to Local Food System
Release Date: 06/02/2021

EPA Uses Emergency Response to Clean Up Bay Retinery to Protect Community
Release Date: 05/14/2021

EPA awards \$615,000 to support environmental justice in communities

EPA United States Environmental Protection Agency

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EPA Grants

EPA Grants Home

Open Opportunities - Grants.gov

Grant Programs-SAM.gov

Overview for Applicants and Recipients

Multipurpose Grants to States and Tribes

- Grant Guidance for Multipurpose Grants to States
- Grant Guidance for Multipurpose Grants to Tribes

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Environmental Justice

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White House Environmental Justice Advisory Council

The White House Environmental Justice Advisory Council (WHEJAC) has been established pursuant to Executive Order 14008, titled *Tackling the Climate Crisis at Home and Abroad*. The White House council will not only bring greater visibility to EJ issues across the federal government but will provide EPA's National Environmental Justice Advisory Council (NEJAC) with an excellent partner for providing horizon expanding EJ advice and recommendations to our government's leadership. As EPA supports the formation of the White House council, we are continuing to support the consistent management of NEJAC, including with our annual membership recruitment process and convening public meetings.

On this page:

- Overview of the WHEJAC
- WHEJAC Membership Selection
- WHEJAC Meetings
- WHEJAC Recommendations

EJ 2020 Action Agenda

National Environmental Justice Advisory Council

Grants and Resources

EJ in Your Community

Federal Interagency Working Group on EJ

EJ and National Environmental Policy Act

EJ and Title VI

EJ for Tribes and Indigenous Peoples

Equitable Development and EJ

Environmental Justice

Office of Legacy Management



The Office of the Secretary's Office of Environmental Policy and Compliance (OEPC) is the coordination and development of environmental policy and program evaluation. Its approach and response to environmental issues that affect multiple bureaus in order to ensure respect to those issues. It provides guidance for the Department's compliance with environmental statutes, executive orders, regulations and other requirements.

Environmental Justice

Office of Legacy Management

U.S. Department of the Interior

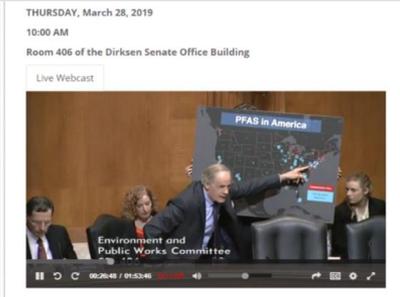
A Review of Executive Order 12958



3. Recommendations for the Task Force

What should legislatures and health and environmental agencies do?

- **Test water in locations with likely contamination**
- **Offer blood testing** to people in exposed areas
- **Proactively target testing** in low-income and BIPOC communities
- **Prioritize EJ communities** for remediation
- **Provide financial support to towns and cities** - remediation is expensive and while some towns and cities have taken early action, many are unaware of the problem or lack financial resources and technical capacity
- **Provide funds** for statewide research, education, testing and surveillance, and remediation
 - Yes, MA has started but we need more
- **Turn off the tap** - stop new uses and emissions of PFAS for all non-essential uses
- **Pass legislation** to restrict many uses of PFAS, including AFFF foam, food packaging, textiles, and carpets, require health insurers to cover blood testing
- **Issue investigative orders** for likely sources (e.g. CA State Water Resources Control Board)
- **Provide education to health providers** so they can properly inform patients



Sen. Carper (D-DE) pointing to our map



Our conferences



Recommendations (continued)

- **Learn from the experts:** Our international conferences (past presentations on our website pfasproject.com), PFAS-Exchange (pfas-exchange.org), Interstate Technology and Regulatory Council (itrcweb.org), National Academy of Science, Green Science Policy Institute (greensciencepolicy.org), Safer States (saferstates.com), Environmental Working Group (ewg.org)
- **Work with the EPA** for national action, including MCLs, Superfund (CERCLA) listing, abolish corporate withholding of data and Confidential Business Information claims
- **Work with academics** in life sciences, natural sciences, and social sciences
- **Work with our Congressional delegation** – Representatives and Senators are playing important roles
- **Use a class-based approach** and don't be fooled into thinking that one or two chemicals at a time is OK
- **Work with community groups** who have always been at the forefront

Community Groups Take the Lead



TESTING *for* PEASE



WESTFIELD
RESIDENTS
ADVOCATING
FOR
THEMSELVES



PFAS ALLIANCE



NATIONAL PFAS
CONTAMINATION
COALITION



PACE (People of Ayer
Concerned about the
Environment)

Emails: pfasproject@gmail.com, p.brown@northeastern.edu, or cordneaa@whitman.edu

Our publications: (happy to share! Just email us)

“Producing Ignorance Through Regulatory Structure: The Case of Per- and Polyfluoroalkyl Substances (PFAS)”
Sociological Perspectives

“What Lessons Should We Learn from the PFAS Crisis?” *Union of Concerned Scientists*

“Environmental chemicals and public sociology: engaged scholarship on highly fluorinated compounds”
Environmental Sociology

“Risky Business? Manufacturer and Retailer Action to Remove Per- and Polyfluorinated Chemicals From Consumer Products” *New Solutions*

“Guideline levels for PFOA and PFOS in drinking water: the role of scientific uncertainty, risk assessment decisions, and social factors” *Journal of Exposure Science and Environmental Epidemiology* (Winner: 2020 Best JESEE Paper from the International Society of Exposure Science)

“Participant Reactions to Medical Screening: A Survey of Satisfaction With the C8 (PFOA) Health Project” *New Solutions*

“Non-stick science: Sixty years of research and (in)action on fluorinated compounds” *Social Studies of Science*

“Can Chemical Class Approaches Replace Chemical-by-Chemical Strategies? Lessons from Recent U.S. FDA Regulatory Action on Per- And Polyfluoroalkyl Substances” *Environmental Science & Technology*